Can increased competition for jobs explain interview lying?

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August 2011

Abstract: We examine a supposedly positive relation between competition in a job contest and interview lying. In the basic model two candidates are interviewed by a recruiter concerning a vacancy. The applicants can be high or low performing, which is private information. During the interviews the applicants make a statement about their performance (a cheap talk phase) and afterwards the recruiter receives two independent signals about the applicants' types. We show that an increase in the expected "quality" of the applicants can (i) cause a sudden increase in interview lying (i.e. failure of a separating equilibrium), and (ii) make the recruiter, ex ante, worse off.

"Today's tough job market understandably heightens the temptation for job seekers to lie in interviews. Competition is fierce and we are aware of the increased need to stand out." *Julian Acquari, Managing Director at Monster UK, HRmagazine.co.uk, February 2009*

"Honesty and integrity are attributes that can be very hard to determine using a formal job interview process: the competitive environment of the job interview may in fact promote dishonesty." *Wikipedia, job interview*

1. Introduction

According to several recent surveys many job seekers lie in their resumes and during interviews. A study from 2010 by the recruitment agency Peninsula Ireland finds that 82% of the respondents admit lying in an interview to land a job. A survey by Monster UK from 2009 indicates that more than a quarter of employees have lied in job interviews. Another study carried out by Galaxy Research indicates that a third of Australian job applicants are guilty of telling great lies during interviews. A New York Times Job Market Report from 2002 shows that 89% of job seekers and 49% of hiring managers in the New York metropolitan area believe that a large number of candidates pad their resumes. According to a poll conducted by the UK based recruitment company HighScores some of the most common lies told in job interviews relates to qualifications, employment history, and skills.

A view often accompanied by these surveys is that interview lying (or fibbing) is on the rise and the reason is increased competition for fewer jobs: skill and education levels are increasing and more people apply for the same positions because of the recession. In other words, the intense competition drives the interviewees to lie about their abilities and qualifications if they want to be taken into consideration for the job. The main purpose of this article is to assess whether this line of reasoning is part of a more formal and complete argument using a simple model of costless signaling. To further motivate our inquiry consider the following example. Suppose we can categorize the job seekers as talented or untalented (given some relevant criteria) and this feature is a priori unobservable to the employer/recruiter. In this case, we would expect those who lack talent, if anyone, to lie about their talent in the interview. Thus, it is not immediate that having more qualified people in the final pool of applicants leads to more interview lying.

In our stylized model a recruiter interviews two applicants concerning an open position. The interviewees can be one of two types: high or low performing. Types are private information. During the interviews the candidates talk about their previous job and in particular whether their performance was high or low. A low type applicant can perfectly, and costlessly, claim to be a high type.[1] After the interviews the recruiter makes a check on the applicants by contacting their previous employers.[2] This reference check is not perfect as some employers are biased in favor of their former employees. A biased employer will always claim that his former employee is the high type whereas an unbiased employer reports that his former employee is a high type if, and only if, he is a high type. Neither the applicants or the recruiter can tell whether a previous employer is biased.

Studying equilibria of such a game we find some (game theoretical) support for the viewpoint that increased competition for jobs makes job seekers lie about their abilities and productivity. Namely, when the previous employers are more likely to be unbiased than biased, there is a threshold for the intensity of competition - captured by the prior probability that the candidates are high performers - such that when competition is low the interviewees are always honest and when competition increases beyond the threshold they lie whenever they are low performers. Paradoxically, there are cases where the recruiter benefits, ex ante, from an increase in the prior probability that the applicants are low performers. When instead the previous employers are more likely to be biased than unbiased only a pooling equilibrium exists and supposedly there is a negative relation between competition (i.e. the prior probability that the applicants are high performers) and interview lying.

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[1] There is no costly signaling a la Spence (1973) and the applicants incur no psychological costs from lying in the job interview. In our model, it is also implicit that a high ability applicant does not possess hard evidence that proves his type.

[2] A survey from 2010 by the Society for Human Research Management shows that only 2 percent of the responding HR professionals never conduct reference background checks on any of its job candidates.

In a few words, the logic behind these results is the following. We start by searching the game for separating equilibria where the applicants report truthfully and the recruiter hires someone who claims to be a high performer. What characterizes an optimal recruiter strategy is that in case applicant i is refuted by his previous employer then applicant j is hired for sure and when both applicants claim to be low types then i is hired with probability one half. Now, if j is always being truthful then i is facing a tradeoff when he is the low type: by lying he will surely get rejected if his previous employer is unbiased and if he reports truthfully his only hope is a fifty-fitfy chance in the instance that j is a low type. Thus, a separating equilibrium can be sustained only if the probability that the previous employers are unbiased is substantial and when competition is lessened. Conversely, if the candidates tend to be high performers only a pooling equilibrium exist: admitting to be a low type when knowing that your opponent is most likely a high type is almost giving up whereas lying and hoping that your previous employer covers you is a better option.

□ **Related literature.** The model that we consider is essentially a persuasion game. The term persuasion refers to situations of strategic communication where the informed sender(s) have interests that are independent of their type (or the state of the world) whereas the less informed decision maker's payoffs from different actions critically depends on the senders' types. Typically, there will be an element of hard evidence in these models. To the best of our knowledge the existing literature on persuasion games and costless signaling does not account for the effects we present in this article.

If we consider our model with only cheap talk (i.e. the previous employers are biased with probability one) then no information transmission will take place in equilibrium. This would correspond to Krishna and Morgan (2001) in the case where the two experts have extreme biases in opposite directions. On the other hand, Grossman (1981), Milgrom (1981), and Milgrom and Roberts (1986) consider various situations involving persuasion where the informed parties can verify their type, which corresponds to our game when the previous employers are unbiased with probability one. They show that the decision maker can force full disclosure by adopting skeptical beliefs towards any person who is withholding evidence.

Glazer and Rubinstein (2004, 2006) study properties of optimal rules of persuasion. Optimality is seen from the perspective of the listener who tries to extract information from a speaker. The speaker's objective is to persuade the listener to accept a certain request (e.g. the speaker wants to convince the listener to offer him a job). Whether the request is justified depends on the values of a number of aspects. The main constraint is that only the true value of one aspect can be disclosed. This type of setting with one informed sender is further explored by Sher (2011). Relatedly, Chakraborty and Harbaugh (2010) consider persuasion and the informativeness of multi-dimensional cheap talk when there is no room for hard evidence. Shin (1994) and Glazer and Rubinstein (2001) consider different aspects of persuasion when there are two informed parties. However, in Shin (1994) and Glazer and Rubinstein (2001) the senders use only hard information to influence the decision maker.

Issues of persuasion has been studied within implementation and mechanism design theory in articles like Lipman and Seppi (1995), Bull and Watson (2004), Deneckere and Severinov (2008), Ben-Porath and Lipman (2009), and Kartix and Tercieux (2010). In these articles the agents usually share information about a common state of the world. In the game we study it is natural (and crucial for the results) that the senders does not share any of the information relevant to the decision maker i.e. the applicants does not observe their opponent's type.

If we move into the literature on costly signaling there are many examples relating to "job market" situations, see Spence (2002). Moran and Morgan (2001) consider a model where unqualified candidates are eliminated by referees in an initial phase and the remaining applicants are ranked after an interview phase. Moran and Morgan (2001) show that the unique equilibrium entails costly falsification by candidates and referees, but despite this, the most qualified candidate is always selected.

3. The game

We consider a game in which two applicants are interviewed by a recruiter regarding an open position in a firm/institution. After conducting the interviews the recruiter must decide which of the applicants to hire.[3] There are two *types* of applicants: one is high performing and the other is low performing. The recruiter does not observe types and applicant i knows his own type but not the type of applicant j. We assume that the probability that applicant 1 is a low type is the same as the probability that applicant 2 is a low type. Denote the probability that applicant i is a low type by $p > 0$ (applicant i is then a high type with probability $1-p$). Like all other aspects of the game this probability is common knowledge among the three players. Let the recruiter's hiring decision be denoted by $a \in [0, 1]$, where a is the probability that applicant 1 is chosen for the job and $1 - a$ is the probability that applicant 2 is hired. The payoff structure is simple: the recruiter receives payoff 1 (0) from choosing a high performer (low performer) and the applicants receive payoff 1 from getting the job and payoff 0 otherwise. Notice that the applicants payoffs does not depend on their type.

During the interviews the candidates state whether their performance in their previous job was high or low. The information transmitted in the interview is undocumented and a low performing applicant can perfectly, and costlessly, claim to be a high type. After the interviews the recruiter receives two independent signals about the candidates types. The signals are imperfect: if applicant i is a high type then signal i is empty (denoted by x) with probability 1. Further, if applicant i is a low type then signal i says "low" with probability $\mu \in (0, 1)$ and it is empty with probability $1 - \mu$. Hence, the result "low" is proof that applicant i is a low performer while the result x does not rule out any of the two possibilities. The interpretation is that the recruiter contacts the applicants previous employers to have some confirmation about their performance. However, some employers are biased in favor of their former employees, to be precise a fraction $1 - \mu$ of them, and they will always tell that their former employee is a high performer. The

[3]The recruiter cannot reject both applicants. This can be justified if the firm is in a hurry to fill in the position or the costs following another call for applications are high. It could also be that the employer wants to maintain a reputation for hiring within the initial opening.

timing of the game is as follows:

Stage 1 (Nature's move). Nature distributes types independently and privately between the two applicants.

Stage 2 (The interviews). The applicants simultaneously send a cheap talk message about their type. A strategy for applicant i specifies for each type of applicant i which message, $m_i \in \{H, L\}$, to send. We only allow the applicants to use pure strategies which is without loss of generality.[4]

Stage 3 (Signals). The recruiter receives two independent signals about the applicants' types.

Stage 4 (The recruiter chooses his strategy). The recruiter listens to the applicants and observes the signals and form beliefs about types. The probability by which the recruiter believes that applicant i is a low type is $\beta_i|[(m_1, m_2), (s_1, s_2)]$, where (s_1, s_2) is some realization of the signals, $s_i \in \{low, x\}$. A strategy for the recruiter, σ_R, specifies for each profile of messages and signals the probability that applicant 1 is hired. Let $a^{\bar{\sigma}_R}|[(m_1, m_2), (s_1, s_2)]$ be the probability, according to $\bar{\sigma}_R$, by which applicant 1 is hired when the profile of messages is (m_1, m_2) and the signals are (s_1, s_2).

Stage 5 (Hiring). Given the applicants messages, the signals, and the recruiter's strategy one of the applicants is hired.

Our equilibrium notion is perfect Bayesian equilibrium (PBE).[5] An equilibrium is *most informative* if, for a given specification of the game, there is no other equilibrium that provides the recruiter with a strictly higher expected payoff. If not otherwise stated, equilibrium payoffs are expressed in ex ante terms. There are three types of equilibria. In a *separating* equilibrium the applicants send H (L) when they are high (low) performing and the recruiter hires a high performer unless both candidates claim to be low types.[6] In this article, an equilibrium is *semi-separating* if one of the applicants send H (L) when he is high (low) type and the other applicant always send the

[4] Our focus is on equilibria that are most informative from the recruiter's persective. It follows from the proof of lemma 1 (iv) that sustaining an equilibrium with partial type revelation (where the applicants are indifferent about lying and truthtelling) would not be less demanding than supporting a fully separating equilibrium.

[5] The choice of equilibrium concept does not play a role in the simple game we study.

[6] To make it simple we ignore separating equilibria where the applicants use the message L (H) to communicate high (low) performance.

same message (H). In a *pooling* equilibrium both applicants send the same message (H) independent of their type.

4. Analysis

In this section we study equilibria of the game and show that indeed it is possible that job interview lying can be explained by the presence of more "high types" relative to "low types". Though, for some parameter values the opposite is true. We state our main result in proposition 1 and accomplish the proof by analyzing separating, semi-separating, and pooling equilibria for varying values of μ and p.

Proposition 1. If we consider the most informative equilibria then job interview lying may suddenly disappear as competition is lessened ($p \uparrow$) and there are cases where the recruiter benefits from an increase in p.

□ **Separating equilibria**. It will be useful to define one particular, and very intuitive, recruiter strategy, $\hat{\sigma}_R$: (A) If both candidates claim to be high types (i.e. both send the message H) and only applicant j is refuted by his previous employer (i.e. $s_j = low$ and $s_i = x$) then i is hired with probability 1 (i.e. $a = 1$). (B) If applicant i claims to be a high type and applicant j claims to be a low type then i is hired with probability 1 unless i is refuted by his previous employer, in which case j is chosen with probability 1. (C) In any other circumstance applicant i is hired with probability 1/2. The strategy $\hat{\sigma}_R$ also follows from table 1 below.

In lemma 1 we state that the interview stage, where the applicants send costless and non-credible messages, can be valuable for the recruiter. That is, the strategy $\hat{\sigma}_R$ supports a separating equilibrium when $\mu \geq \frac{1}{1+p}$. The existence of such an equilibrium depends positively on the precision of the signals (μ) and the probability that the applicants are low types (p). Intuitively, the disciplining effect of punishing the applicants in case they have been disproven by their previous employer increases as the fraction of biased employers decreases. Secondly, if we want to encourage truthtelling then applicant i must face a positive probability of getting hired if he admits being

Table 1: Recruiter strategy $\hat{\sigma}_R$

$[(m_1, m_2), (s_1, s_2)]$	**a**	$[(m_1, m_2), (s_1, s_2)]$	**a**
$[(H, L), (x, x)]$	1	$[(H, H), (x, x)]$	1/2
$[(H, L), (x, low)]$	1	$[(H, H), (x, low)]$	1
$[(H, L), (low, x)]$	0	$[(H, H), (low, x)]$	0
$[(H, L), (low, low)]$	0	$[(H, H), (low, low)]$	1/2
$[(L, H), (x, x)]$	0	$[(L, L), (x, x)]$	1/2
$[(L, H), (x, low)]$	1	$[(L, L), (x, low)]$	1/2
$[(L, H), (low, x)]$	0	$[(L, L), (low, x)]$	1/2
$[(L, H), (low, low)]$	1	$[(L, L), (low, low)]$	1/2

a low type - something that the recruiter can do only if he believes that applicant j is a low type too. We also show that the separating equilibrium supported by $\hat{\sigma}_E$ is robust in the sense that applicant i's optimal strategy does not depend on applicant j's strategy choice. Finally, the condition $\mu \geq \frac{1}{1+p}$ is necessary for the existence of *any* separating equilibrium.

Lemma 1. (i) The strategy $\hat{\sigma}_R$ supports a separating equilibrium if $\mu \geq \frac{1}{1+p}$. (ii) When $\mu \geq \frac{1}{p+1}$ and the recruiter's strategy is $\hat{\sigma}_R$ then truthtelling is optimal for applicant i independent of applicant j's strategy. (iii) In a separating equilibrium the recruiter's expected payoff is $1 - p^2$. (iv) When $\mu < \frac{1}{1+p}$ no separating equilibrium exist.

Proof. Suppose the applicants report truthfully (i.e. they send H (L) when they are high (low) types) and the recruiter applies $\hat{\sigma}_R$ and his posterior beliefs are such that whenever applicant i send H (L) he believes that i is high (low) type unless i send H and $s_i = low$. Clearly the recruiter's belief updating can be generated from the applicants strategies using Bayes' rule whenever possible. It is also immediate that $\hat{\sigma}_R$ is optimal given these beliefs and the applicants strategies.

Turning to the applicants it is clear that applicant 1 could not be strictly better off from sending L when he is the high type. Consider the deviation where applicant 1 send H when he is the low type. Applicant 1's expected payoff from sending L conditional on being the low type is $p/2$: the only chance for applicant 1 to be hired is when applicant 2 send L (he does that with probability p) in which case applicant 1 is hired with probability $1/2$. If applicant 1 deviates and send H when he is the low type his expected payoff conditional on being the low type is $p(1-\mu)+\frac{(1-p)(1-\mu)}{2}$. The first term follows from the fact that applicant 1 will be hired if applicant 2 send L (he does that with probability p) and applicant 1 is lucky with his signal i.e. $s_1 = x$ (happens with probability $1-\mu$). Further, applicant 1 will be hired with probability $1/2$ if applicant 2 send H (probability $1-p$) and $s_1 = x$ (probability $1-\mu$). Comparing the expected payoffs we get that truthtelling is optimal if $\frac{p}{2} \geq p(1-\mu)+\frac{(1-p)(1-\mu)}{2}$. Simplified, if $\mu \geq \frac{1}{1+p}$. The same if we take the perspective of applicant 2. We conclude that $\hat{\sigma}_R$ supports a separating equilibrium if, and only if, $\mu \geq \frac{1}{1+p}$ which proves part (i).

For part (ii) we only need to show that if the recruiter applies $\hat{\sigma}_R$ and applicant 2 always send H then truthtelling is still optimal for applicant 1 when $\mu \geq \frac{1}{1+p}$. Clearly, truthtelling is optimal when applicant 1 is the high type. Suppose applicant 1 is the low type. By sending L applicant 1 receives, conditional on being the low type, an expected payoff equal to $p\mu$. That is, applicant 1 will be hired if, and only if, applicant 2 is the low type and $s_2 = low$. If applicant 1 sends H he obtains $\frac{p}{2}+\frac{(1-p)(1-\mu)}{2}$. The first term comes from the fact that applicant 1 will be hired with probability $1/2$ when applicant 2 is the low type. Second, applicant 1 will be hired with probability $1/2$ when applicant 2 is the high type and $s_1 = x$. Comparing truthtelling to lying and rearranging we get that truthtelling is optimal if $\mu \geq \frac{1}{1+p}$. In a similar way if we take the perspective of applicant 2. Part (iii) of proposition is immediate given that, in a separating equilibrium, the recruiter hires a high performer unless both candidates are low types. See the appendix for part (iv).

Remark 1. In our model the applicants have only two types. If we follow the intuition from the results of lemma 1 and consider the extension of $\hat{\sigma}_R$ with many types (i.e. a symmetric recruiter strategy that encourages the applicants to claim "higher" types and punish them in case of disproval) it becomes increasingly difficult to sustain a separating equilibrium where the *lowest* type is honest (e.g. with a uniform type distribution the probability that the other truthful applicant is also the lowest type shrinks with the number of types). On the other hand, we may have that for intermediate values of μ and p a partially separating equilibrium exists where the applicants are honest up to a certain point e.g. applicant i reports truthfully whenever he is high or medium type and lies when he is the low type.

□ **Semi-separating equilibria**. We define a semi-separating equilibrium to be when applicant i reports truthfully and applicant j always send the same message (H). It follows, in this equilibrium the recruiter hires applicant i whenever he claims to be the high type and the recruiter hires applicant j in case i sends L and signal j is indeterminate. Hence, the recruiter never makes a mistake (i.e. appointing a low performer when the other interviewee is a high performer) and the recruiter's equilibrium payoff is the same as in a separating equilibrium. It also turns out that the conditions for the existence of a semi-separating equilibrium overlaps with those for a separating equilibrium.

Lemma 2. (i) A semi-separating equilibrium exists if, and only if, $\mu \geq \frac{1}{1+p}$. (ii) In a semi-separating equilibrium the recruiter's expected payoff is $1-p^2$.

Proof. See appendix.

□ **Pooling equilibria**. As it is typical for games of costless signaling a pooling (babbling) equilibrium exists under general conditions. Think of the case where the applicants always claim to be high types and the recruiter ignores the interviews and chooses according to the signals. In lemma 3 we state that the strategy $\hat{\sigma}_R$ is part of a pooling equilibrium when $\mu \leq \frac{1}{1+p}$.

Lemma 3. (i) When $\mu \leq \frac{1}{1+p}$ the recruiter strategy $\hat{\sigma}_R$ is part of a pooling equilibrium. (ii) In a pooling equilibrium the recruiter's expected payoff is

$1 - p^2 - p(1-p)(1-\mu)$.

Proof. Let $\mu \leq \frac{1}{1+p}$. Suppose the applicants always send H and the recruiter applies $\hat{\sigma}_R$. Further, the recruiter's posterior believes are such that if applicant i send H and $s_i = x$ then he believes that i is a low type with probability $\frac{p-p\mu}{1-p\mu}$. Otherwise, the recruiter believes that applicant i is a low type with probability 1. It follows from the proof of lemma 1 that lying (sending H when low type) is optimal for applicant 1 (2) when applicant 2 (1) always send H and $\mu \leq \frac{1}{1+p}$. It is straightforward that the recruiter's beliefs are consistent (following Bayes' rule when the candidates send H) and his strategy is optimal given the beliefs and the applicants strategies.

Consider part (ii). We claim that in a pooling equilibrium the employer's expected payoff is $1 - p^2 - p(1-p)(1-\mu)$. The second term follows from the fact that the recruiter hires a low type when both candidates are low types. The third term follows from the fact that when one of the candidates is a low type (happens with probability $2p(1-p)$) and both signals are indeterminate (happens with probability $1-\mu$ given that exactly one applicant is a low type) then the employer will hire a low performer with probability $1/2$. □

□ **Summary**. In this section we conclude on the equilibrium analysis and focus on the most informative equilibria. This sub-section also completes the proof of proposition 1. When a relatively large proportion of the previous employers are biased and the pool of candidates tend to be high performers, to be exact when $\mu < \frac{1}{1+p}$, only a pooling equilibrium exist. In this equilibrium the applicants always send H i.e. they lie whenever they are low performers. Hence, the probability that applicant i is lying in the interview is p and thus lying increases with p. From the recruiter's perspective the interview stage is worthless and the chances of hiring a high performer is increasing in μ and decreasing in p (this is intuitive and can be verified by differentiating the recruiters expected payoff in lemma 3 (ii) with respect to μ and p). Notice, when the previous employers are more likely to be biased than unbiased ($\mu \leq 1/2$) the pooling equilibrium prevails independent of p.

Once we reach the threshold ($\mu = \frac{1}{1+p}$) the probability that applicant i is lying goes from p to zero, once we consider the fully separating equilibrium. For example, if $\mu = 2/3$ and p increases from $p' < 0.5$ to $p'' \geq 0.5$ then job interview lying goes from p' percent to nothing. This example demonstrates a drastic decrease in lying cause by a "weaker" pool of candidates. As long as $\mu \geq \frac{1}{1+p}$ truthtelling persists and the probability that the recruiter hires a high performer is unaffected by μ and decreases with p (see lemma 1 (iii) and lemma 2 (ii)). Again, the fact that the recruiter benefits from an increase in the prior probability that the interviewees are high types is not surprising. However, given a shift from a pooling to a separating equilibrium, it is easy to provide examples where the recruiter is better off from an increase in p! Consider table 2 below for $\mu = 2/3$. When $p = 0.49$ the recruiter hires a high performer with probability 0.68 (approximately) and when $p = 0.51$ a high performer is hired with probability 0.74 (approximately).[7] In comparison, if the recruiter chooses randomly a high type is chosen with probability 0.49. In this case, clearly the interview stage makes a difference for the recruiter.

Generally speaking, the analysis shows that the positive effects on the recruiter's expected payoff from large decreases in p can easily be overstated because of the shift from separating to pooling equilibria. For example, given $\mu = 2/3$, if p decreases from 0.5 to 0.25 (i.e. a significant increase in the "quality" of the pool of candidates) the chances of hiring a high performer increases by only 12.5 percentage points (from 75% to 87.5%). In comparison, if we only consider pooling equilibria the chances of success goes from 67% to 87.5% (see table 2).

Remark 2. In our model we assumed that μ is exogenous. However, this does not exactly match reality: firms can invest in more investigation of the applicants (e.g. contacting more people from the applicants' employement/education history) and thereby, to some extend, increase μ. From the analysis we can say something about under what circumstances the recruiter stand to gain most from an increase in μ. If p is high and thus a separating equilibrium exist for intermediate values of μ it is wasteful to further increase μ (see lemma 1 (iii)). However, if both p and μ are relatively low

[7] These numbers comes from inserting the values of μ and p in the expressions for the recruiter's expected payoff in a pooling and separating equilibrium, respectively.

Table 2: Chance that a high performer is hired for $\mu = 2/3$

	Random pick	Pooling equilibrium	Separating equilibrium
$p = 0.25$	75 %	87,5 %	NA
$p = 0.49$	51 %	68 %	NA
$p = 0.50$	50 %	67 %	75 %
$p = 0.51$	49 %	66 %	74 %
$p = 0.75$	25 %	37.5 %	44 %

(i.e. only a pooling equilibrium exist) the recruiter is more likely to appoint a high performer as μ increases ((lemma 3 (ii)). Moreover, as μ increases the applicants may shift to a separating equilibrium and the positive effects from intensifying the checking of applicants is even greater. For example, if $p = 1/2$ and μ is just below $2/3$ then the chances of success is less than 66% and from a small increase in μ this percentage jumps to 75.

$\square$ **More than two candidates**. Another aspect of competition in the selection process is the number of candidates invited for interviews. In this sub-section we consider the game with one more applicant. We find the same tendency: increased competition (conducting interviews with more people) makes it harder to sustain a separating equilibrium which may eventually hurt the recruiter.

Consider the basic model with three applicants. Thus, the recruiter receives three independent signals about the applicants types. Further, the recruiter's hiring decision is now represented by a vector of probabilities where the i'th entry ($i = 1, 2, 3.$) denote the probability that applicant i is hired. Like in the basic model these probabilities must add to one. Again, p is the prior probability that applicant i is low type and the parameter μ governs the signals. Now, consider the extension of $\hat{\sigma}_R$ which we call σ'_R: (A) If applicant i claims H and i is not refuted by his previous employer ($s_i = x$) then i is hired with probability $1/k$, where k is the number of non-refuted candidates claiming H. (B) If all the candidates claiming H have been refuted then any applicant, i, claiming L will be hired with probability $1/m$, where m is the number of applicants claiming L. (C) Otherwise, applicant i is hired with probability 1/3.

From proposition 2 below we get that σ'_R supports a separating equilibrium if, and only if, $\mu \geq \frac{1+p}{1+p+p^2}$.[8] Thus, the recruiter can induce truthtelling in the interviews if the previous employers are reliable and the applicants tend to be low types. This last point follows from differentiating the expression $\frac{1+p}{1+p+p^2}$ with respect to p, which is negative. When $\mu \leq 2/3$ no separating equilibrium exists irrespective of p. The important thing to notice is that interviewing one more applicant makes it harder to induce truthtelling: if $\mu \geq \frac{1+p}{1+p+p^2}$ then clearly $\mu \geq \frac{1}{1+p}$ but the reverse is not always true. The fact that increasing the number of candidates makes it more tempting to lie for someone who is the low type is not surprising: with many applicants invited for interviews it is likely that at least one of them is a high performer who will also claim to be such and certainly receive a positive reference check.

Proposition 2. With three applicants the recruiter strategy σ'_R supports a separating equilibrium if, and only if, $\mu \geq \frac{1+p}{1+p+p^2}$.

Proof. Suppose all the applicants report truthfully and the recruiter applies σ'_R. Further, the recruiter's posterior beliefs are such that whenever applicant i send H (L) he believes that i is high (low) type unless i send H and $s_i = low$. Surely the recruiter's belief updating can be generated from the applicants strategies using Bayes' rule when possible. It is immediate that σ'_R is optimal given these beliefs and the applicants strategies.

Clearly, applicant i could not be better off from sending L when he is the high type. Consider the deviation where applicant i send H when he is the low type. Applicant i's expected payoff from sending L conditional on being the low type is $\frac{p^2}{3}$. It follows, the only chance for applicant i to be hired is when the other applicants send L (happens with probability p^2) in which case i is hired with probability 1/3. If applicant i instead send H his expected pay-

[8]There is no reason to believe that a separating equilibrium exists when $\mu < \frac{1+p}{1+p+p^2}$. As with two applicants, we can argue that if the candidates report truthfully then changing σ'_R (without making the recruiter worse off) cannot make applicant i's lying deviation less attractive without making other applicants lying options comparably more attractive.

off conditional on being the low type is $(1-\mu)p^2+(1-\mu)(1-p)p+\frac{(1-\mu)(1-p)^2}{3}$. The first term follows from the fact that applicant i will be hired if the other applicants send L (happens with probability p^2) and applicant 1 is lucky with his signal i.e. $s_i = x$ (happens with probability $1-\mu$). Further, i will be hired with probability $1/2$ if only one of the other applicants send H (happens with probability $2(1-p)p$) and $s_i = x$. Finally, i will be hired with probability $1/3$ if the other applicants send H and $s_i = x$. Comparing truthtelling to lying when applicant i is the low type we get that (after rearranging and simplifying) reporting truthfully is optimal if, and only if, $\mu \geq \frac{1+p}{1+p+p^2}$. □

□ **Other applications**. Whereas the model was formulated in the spirit of a job contest the type of setting and the effects we have demonstrated are relevant to a larger class of problems involving persuasion. Consider the following three situations which are variations of well known examples discussed in the literature.

A buyer is determined to buy a specific used car. There are two used car sellers in the buyer's area that offers this car for sale at approximately the same price. Only the sellers know the true condition (good/bad) of the cars they have for sale. Before deciding who to buy from the buyer makes a couple of test drives which, with some probability, will tell if a car is in a bad condition. The question, in relation to this article, is whether we should expect the dealers to be earnest about car quality depending on the fraction of bad cars to good cars and the effectiveness of the test drives.

The director of a research institute is deciding which of several projects to support. Researchers affiliated with institute apply for the same funds and state whether the prospects of their research are high. The director prefers to support any project with high promises whereas the researchers would like to receive funding independent of the quality of their research. The director has limited time to go through each project and she may detect serious weaknesses in the projects, if there are any.

A legislator must decide whether to accept a request from an entrepreneur to build a new shopping mall. A hearing is conducted and a lobbyist from the industry and one from an environmentalist group will testify. The lobbyist from the industry knows whether profitability is expected to be high and the lobbyist from the environmentalist organization knows whether the potential damage on the local environment is serious. The lobbyists are one-sided and they are not required to testify under oath. If damage on the local environment will be high (low) and profitability low (high) the legislator prefers to reject (accept) the request. Otherwise, she is indifferent. Before deciding the legislator receives an external report that may document these effects.

5. Conclusion

In this article we have addressed the issue of interview lying (or fibbing), which according to recent surveys seems to be the norm for many people. Our main inquiry was to examine the postulate that increasing shares of "high type" candidates can explain the prevalence of lying. From a simple game of cheap talk we found that under some circumstances this is indeed true. When the posterior signals about the interviewees past performance are sufficiently strong then lying critically depends on the probability that the candidates are high types. On the one hand, when competition is strong only a pooling equilibrium exist and we may say that the applicants lie whenever they are low types. On the other hand, as the proportion of low types reaches a certain threshold a separating equilibrium exist where it pays to be honest. As a consequence, there are cases where the hiring institution benefits from a weaker pool of candidates. More generally, the positive effects from a large increase in the expected "quality" of the applicants can easily be overstated.

The results suggest that countries, sectors, and firms that attract many high talented and skilled people will also have the most problems with job applicant lying. In the same way, we would expect that issues of interview lying intensifies as we move upwards in the organizational hierarchy. Moreover, the problem worsens in a recession where more high ability individuals are unemployed. In this light, "high-end" firms, particular in recession times, stand to gain a lot from investing time and effort in clearing their future employees in order to detect more "bad" applicants and encourage honesty. Testing these predictions (e.g. obtaining data from employee screening firms) and the basic dynamics of our interview game (e.g. through a laboratory experiment) is something that is left for future research.

Appendix

Prof of lemma 1 (iv). By contradiction. Suppose $\bar{\sigma}_R \neq \hat{\sigma}_R$ is part of a separating equilibrium when $\mu < \frac{1}{1+p}$. Define w_{i,σ_R^*} to be the change in applicant i's expected payoff from claiming H instead of L conditional on i being the low type and that applicant j reports truthfully when the recruiter strategy is σ_R^*. We know from the proof of lemma 1 (i) that $w_{1,\hat{\sigma}_R}$ and $w_{2,\hat{\sigma}_R}$ are positive for $\mu < \frac{1}{1+p}$. In order for our initial supposition to be true we must have that $w_{1,\bar{\sigma}_R}$ and $w_{2,\bar{\sigma}_R}$ are non-positive. In the following we check whether it is possible that $w_{1,\bar{\sigma}_R}$ *and* $w_{2,\bar{\sigma}_R}$ could be lower than $w_{1,\hat{\sigma}_R}$ and $w_{2,\hat{\sigma}_R}$, respectively, provided that $\bar{\sigma}_R$ is optimal given that the candidates report truthfully and the recruiter updates his beliefs according to Bayes' rule. If not, we reach a contradiction as one of the applicants, or the recruiter, will have a profitable deviation.

Consider the recruiter response denoted $a^{\bar{\sigma}_R}|[(H,L),(x,x)]$. In order for $\bar{\sigma}_R$ to be optimal given that the applicants report truthfully and consistent beliefs deriving from such strategies we must have that $a^{\bar{\sigma}_R}|[(H,L),(x,x)] = 1$. That is, after observing that applicant 1 send H and applicant 2 send L and both signals are empty the employer believes that applicant 1 is a high type and applicant 2 is a low type and it is optimal to hire applicant 1. Similarly, we must have that $a^{\bar{\sigma}_R}|[(H,L),(x,low)] = 1$ and $a^{\bar{\sigma}_R}|[(L,H),(x,x)] = a^{\bar{\sigma}_R}|[(L,H),(low,x)] = 0$. So far $\hat{\sigma}_R$ and $\bar{\sigma}_R$ are identical.

Now suppose $a^{\bar{\sigma}_R}|[(H,L),(low,x)] > 0$. We know that $a^{\hat{\sigma}_R}|[(H,L),(low,x)] = 0$. Consider the effects on w_1 and w_2 from an increase in $a|[(H,L),(low,x)]$. First, there is no movement in w_2 from such a change since this end note is never reached as long as applicant 1 reports truthfully. Second, there is an increase in w_1: applicant 1's lying deviation (i.e. sending H when he is the low type) becomes more attractive when he is not punished to the maximum extend after he is detected in lying. In the same way, lying becomes more attractive whenever $\bar{\sigma}_R$ departs from $\hat{\sigma}_R$ with respect to the recruiter responses:

$a|[(H,L),(low,low)]$, $a|[(L,H),(x,low)]$, $a|[(L,H),(low,low)]$, $a|[(H,H),(low,x)]$, and $a|[(H,H),(x,low)]$. Concluding on this, there is no loss in letting $\bar{\sigma}_R$ be equal to $\hat{\sigma}_R$ when it comes to the recruiter responses considered here.

We now consider the effects of letting $\bar{\sigma}_R$ differ from $\hat{\sigma}_R$ with respect to the recruiter response $a|[(L,L),(low,x)]$. If we increase $a|[(L,L),(low,x)]$ then, everything else equal, applicant 1's expected payoff from telling the truth when he is the low type increases. In fact, if Δa is the increase in $a|[(L,L),(low,x)]$, then w_1 decreases by an amount equal to $\Delta ap(1-\mu)\mu$. That is, when applicant 2 send L and $s_2 = x$ (happens with probability $p(1-\mu)$) and $s_1 = low$ (happens with probability μ given that applicant 1 is the low type) then applicant 1 face renewed chances of getting hired (Δa). At the same time w_2 increases by the same amount: $\Delta ap(1-\mu)\mu$. It follows, when applicant 1 send L (probability p) and the signals are $s_1 = low$ and $s_2 = x$ (with probability $\mu(1-\mu)$) then applicant 2 is less likely to get the job and it becomes relatively more attractive for him to lie and send H. We get the opposite effects if we decrease $a|[(L,L),(low,x)]$. In a similar way, the effects on w_1 and w_2 from variations in $a|[(L,L),(x,low)]$, $a|[(L,L),(x,x)]$, and/or $a|[(L,L),(low,low)]$ are opposite and equal in magnitudes. Hence, if w_1 and w_2 are positive (i.e. both applicants are better off lying when low types) for some recruiter strategy then varying the recruiter responses considered here cannot make both w_1 and w_2 negative or zero. The same applies for the recruiter responses that we consider below.

Consider $a|[(H,H),(low,low)]$. Varying $a|[(H,H),(low,low)]$ does not affect applicant i's expected payoff from either truthtelling or lying given that applicant j reports truthfully (i.e. w_i is unaffected). Finally, consider $a|[(H,H),(x,x)]$. By increasing $a|[(H,H),(x,x)]$ we make it more attractive for applicant 1 to lie when he is the low type. To be precise, w_1 increases by an amount equal to $\Delta a(1-p)(1-\mu)$, where Δa is the increase in $a|[(H,H),(x,x)]$. The reason is, when applicant 1 is the low type and sends H his chances of getting hired increases given that applicant 2 is the high type and $s_1 = x$. However, in the same way applicant 2 is discouraged from lying and w_2 decreases by $\Delta a(1-p)(1-\mu)$. We get the opposite effects if we decrease $a|[(H,H),(x,x)]$. Concluding all together, we reach that either

$\bar{\sigma}_R$ is not optimal given consistent beliefs or $w_{1,\bar{\sigma}_R}$ and/or $w_{2,\bar{\sigma}_R}$ are positive when $\mu < \frac{1}{1+p}$ (knowing that $w_{1,\hat{\sigma}_R}$ and $w_{2,\hat{\sigma}_R}$ are positive for $\mu < \frac{1}{1+p}$) and the desired contradiction is obtained. □

Proof of lemma 2. Consider the following equilibrium candidate: applicant 1 send H (L) when he is the high (low) type and applicant 2 always send H. The recruiter's strategy, σ_R^*, is such that when both applicants send H then applicant 1 is hired unless $s_1 = low$, in which case applicant 2 is hired with probability 1. If applicant 1 send L and applicant 2 send H then applicant 2 is hired unless $s_2 = low$, in which case applicant 1 is hired with probability 1. Finally, if applicant 2 send L then applicant 1 is hired independent of the message from applicant 1 and the content of the signals. The recruiter believes that applicant 1 is a low type whenever applicant 1 send L and when applicant 1 send H and $s_1 = low$. Otherwise, he believes that applicant 1 is the high type with probability 1. Further, the recruiter believes that applicant 2 is the low type with probability $\frac{p-p\mu}{1-p\mu}$ whenever applicant 2 send H and $s_2 = x$. Otherwise, he believes that applicant 2 is the low type with probability 1.

We now argue that this situation constitute a semi-separating equilibrium if $\mu \geq \frac{1}{1+p}$ (the "if" part of lemma 2 (i)). It is straightforward to check that the recruiter's posterior beliefs on-the-path can be generated from the applicants strategies using Bayes' rule. It is also immediate that the recruiter's strategy is optimal given the applicants strategies and his beliefs. We now check the applicants strategies. Clearly, applicant 2 is worse off from changing strategy and applicant 1 has no interest in sending L when he is the high type. Suppose applicant 1 is the low type. If applicant 1 stick to his strategy his expected payoff conditional on being the low type is $p\mu$. That is, applicant 1 will be hired when applicant 2 is the low type and $s_2 = low$ (the probability of this event is $p\mu$). If applicant 1 lies his expected payoff conditional on being the low type is $1 - \mu$ (i.e. applicant 1 will be hired for sure if he is lucky with his signal). Once we compare and rearrange we get that truthtelling is optimal if and only if $\mu \geq \frac{1}{1+p}$. It follows from the equilibrium above (when $\mu \geq \frac{1}{1+p}$) that the recruiter only hires a low performer when both applicants are low types (probability p^2) and his expected payoff is $1-p^2$ (this proves part (ii)).

We next argue that no semi-separating equilibrium exists when $\mu < \frac{1}{1+p}$ (the "only if" part of lemma 2 (i)). Suppose on the contrary that some recruiter strategy, σ'_R, supports a semi-separating equilibrium when $\mu < \frac{1}{p+1}$. Assume that the applicants strategies are such that applicant 1 send H (L) when he is the high (low) type and applicant 2 always send H. As σ'_R must be optimal given the applicants strategies and the believes deriving from these strategies we should have that applicant 1 is always hired when both applicants send H and $(s_1, s_2) = (x, low)$ or $(s_1, s_2) = (x, x)$. Hence, $a^{\sigma'_R}|[(H,H),(x,low)] = a^{\sigma'_R}|[(H,H),(x,x)] = 1$. On the other hand, applicant 2 must be hired when the profile of messages is (L,H) and the signals are $(s_1,s_2) = (x,x)$ or $(s_1,s_2) = (low,x)$. That is, $a^{\sigma'_R}|[(L,H),(x,x)] = a^{\sigma'_R}|[(L,H),(low,x)] = 0$).

Now consider our equilibrium and applicant 1's option to send H when he is the low type. To make this deviation as unattractive as possible for applicant 1 we let $a^{\sigma'_R}|[(L,H),(x,low)] = a^{\sigma'_R}|[(L,H),(low,low)] = 1$ and $a^{\sigma'_R}|[(H,H),(low,low)] = a^{\sigma'_R}|[(H,H),(low,x)] = 0$. Now, compare applicant 1's expected payoff from truthtelling versus lying when he is the low type: sending L gives $p\mu$: applicant 1 will be hired when applicant 2 is the low type (probability p) and the signal proves his type (probability μ). Applicant 1's expected payoff from sending H is $1-\mu$: applicant 1 will be hired if, and only if, $s_1 = x$. Once we compare and rearrange we get that the lying deviation is profitable when $\mu < \frac{1}{1+p}$ and this leads us to a contradiction of the initial supposition. $\square$

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